PLANT SPECIES IDENTIFICATION, POTENTIAL USE AND INVASIVENESS

A Training Workshop: Optimisation of Pesticidal-plants- Technology Innovation, Outreach and Networks (OPTIONs)

By

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Introduction

- Man has always classified things for the accurate recognition of food, fuel, medicines and building materials among others, which are essential for his survival on earth.
- The East African Herbarium undertakes taxonomic research of plants and fungi (mushrooms).
- Taxonomy involves Identification, Naming and Classification.
Role of taxonomy

- **Identification** - How can plants be recognized?
- **Nomenclature** - What should they be called in order that information about them can be freely exchanged without ambiguity (E.g. use of ICBN, Melbourne revision, 2012).
- **Classification** - What are their closest relatives? Are there plants likely to have similar properties or compatible genetic systems? (e.g. use Flora of Tropical East Africa)
- **Diversity** - of species: How many species are there in Kenya? (Vascular species 7004)
- **Floral Distribution** - Where do they grow?
- **Phenology** - when do they flower or fruit?
- **Ecology** - Where do they grow?
- **Uses** - Have they any useful properties?
Plant identification

Identification - naming of an organism by reference to an already existent classification

Local names

- Have evolved over centuries in many languages
- Used within a geographical region
- One plant may therefore be known by several different names
- One name may apply to several different plants
Methods of Plant Identification

1. Pictures and illustrations.
2. Identification Keys in botanical books and Floras i.e.
   • dichotomous keys, then
   • Matching in herbarium.
3. Asking experts
Plant Identification tools

- Herbarium
- Reference material (FTEAs, Journals, Monographs, UPWF, KTSL, etc)
- Plant glossary
- Hand lens
- Microscope
- Dissecting kit
- Ruler

Reference literature for plant species identification
Plant Morphology

• “The way in which plants are constructed”
• Why important to study?
  - For quick and easy identification
  - Writing descriptions
Morphology: Key characters for plant ID

- Habit (herb, shrub, tree, liana/climber)
- Sap
- Leaf (simple, compound, etc.)
- Stipules
- Hairs and glands
- Floral
- Fruit
- Seed
Habit

- Herb
- Climbing:
  - Scrambler
  - Twiner
  - Liana (woody climber)
- Shrub
- Tree
Trunks and stems

- Branching patterns
  - Notable?

- Bark
  - Colour
  - Texture
  - ? Peeling/flaking
  - ? Spines
Sap or exudate

- Present/absent from wounds or cuts?

- Colour of sap?
  - Yellow, white, red, etc
  - Changes upon drying or exposure (e.g. from translucent to black or red)

- Smell?
Leaf morphology

- Petioles
  - Varying lengths (sessile, ? cm long..)
  - Swollen nodes
  - Winged

Thika palm-(Filicium decipiens)
Leaf morphology

- Simple – undivided blade
- Compound – fully subdivided blade
Leaf morphology

- Leaf arrangement
  - Alternate
  - Opposite
- Venation
- Hairs & glands
Leaf morphology

- Leave margin
  - Dentate
  - Serrate
  - Smooth
Leaf morphology

- Shapes - Ovate, Elliptic, Heart-shaped, Linear
- Apices - acute, acuminate, rounded, etc
- Bases – cuneate, cordate, etc
LEAVE PARTS

LEAF SHAPE

- elliptic
- ovate
- obovate
- linear
- lanceolate
- spatulate
- narrowly
- broadly
- narrowly
- broadly

- cuneate
- rounded
- obtuse
- attenuate
- cordate
- oblique
- truncate
- auriculate

- acute
- rounded
- obtuse
- acuminate
- emarginate
- macronate
- truncate
- caudate

SIMPLE LEAVES

- simple, entire
- simple, palmately lobed
- digitately divided

- pinnately lobed
- pinnately divided

- imparipinnate
  - (single top leaflet)
- paripinnate
  - (pair of top leaflets)
- bipinnate

COMPOUND LEAVES

- bi-foliolate
- tri-foliolate
Inflorescences & Flowers

- Arrangement – solitary, racemes, spikes
- Symmetry
- Colour
- Floral parts – number of stamens, petals, sepals
- Position of the ovary – superior, inferior, semi-inferior
Inflorescences & Flowers
Flower and Inflorescence types

- Receptacle
- Sepals (forming calyx)
- Pedicel
- Anther
- Filament
- Ovary
- Stamen
- Stamens included
- Stamens exerted
- Corolla of free petals
- Corolla of tube (fused part) and lobes
- Ovary of fused carpels; styles free, 4
- Ovary without style

Position of Inflorescence
- Terminal
- Axillary

Inflorescence Types
- Fascicle
- Umbel
- Corymb
- Raceme
- Spike
- Panicle
- Cyme (4 types)

Monoecious
- All flowers bisexual
- Male and female separate, but on the same tree

Dioecious
- Male and female on separate trees

Inflorescence Terms
- Pedicel
- Bracts
- Peduncle
Fruits

- Simple or aggregated/compound
- Succulent/ fleshy
- Dehiscent or indehiscent (when dry)
Fruit types

Fleshy Fruits
- Berry: No hard layer; 1-many seeded
- Drupe: 1-several seeds, each surrounded by a juicy layer

Dry Fruits - Indehiscent (not splitting open)
- Achene: Small, single-seeded
- Samara: Winged achene
- Nut: Single seeded, with woody inner layer

Dehiscent Fruits (splitting open)
- Follicle: Splits on one side
- Legume: Splits into 2 valves
- Capsule: Splits into several valves; dry

General Terms
- Fruit with 2 mericarps: Monocarps and mericarps originate from a single flower
- Fruit with many monocarps: Mericarps originate from many flowers close together
- Fruit syncarpous: Originates from many flowers close together

Shape Terms
- Round
- Ellipsoid
- Ovoid
- Obovoid
- Obconic
- Cylindrical
- Fusiform
Diversity of plants in Kenya

- 12317 vascular plant species in East Africa, 7004 in Kenya (Mwachala et al., 2014).
- In addition,
- 766 - bryophytes
- 2071 – fungi
Diversity according to vegetation zones

Vegetation ecosystems (Lillesø et al., 2011; White, 1983)

1. Somali-Masai (80% of Kenya from Tsavo to North eastern, between 500 m to c. 2000 m a.s.l.)
2. Afromontane (Highlands, > 2000 m a.s.l.)
3. Swahilian Zanzibar-Inhambane (coastal forests),
4. Lake Victoria savanna
5. Guinea-Congolian mosaics (Kakamega)

Highest diversity of plants found in Somali-masai (especially hilltops) with 4721 species, coastal forests (e.g. Shimba hills 3000).
Places of highest plant species concentration and endemism

- Highest in eco-climatic zones 1-3
- 577 (8%) are endemic (plants found only in Kenya or East Africa)
- High endemism in Central Highlands and the Coastal forest.
- The highest proportion of endemic plants are found in the arid environments
Plant uses

Over **800 plant species** in Kenya with potential uses. For example;

1. **Food** (800 species. fruits form about 50%, leaf vegetables 25%, tuber and root species 12.5%
   *see Maundu, et al., 1999*).

2. **Fodder and forage** (livestock and pollinators such as bees)

3. **Medicines** (80% of the world's people rely on traditional medicine)

4. **Pesticides** (e.g. *Securidaca longipedunculata, Zanha africana, Tithonia diversifolia, Tagetes
   minuta, Lippia javanica*)

5. **Fibre and dyes** (e.g. *Euclea divinorum for dying kiondo*).

6. **Fuel and firewood**

7. **Building** e.g. Kiang’ombe Hill (Mbeere), annual average household forest value esti. KSh. 16,175.6 (US$256.80), i.e. 55.4% of household income (*Ngugi et al., 2011*).

8. **Manufacturing** (e.g glue, soap, cosmetics, lubricants)

9. **Ornamentals** (Succulent plants such as aloes and euphorbia)

10. **Protection of soil erosion**

11. **Ecosystem services** *insect pollination*
Resource references
Some medicinal and pesticidal plants

Examples
1. *Croton dichogamus* (Muthinia)
2. *Securidaca longipedunculata* (Muuca)
3. *Zanha africana* (Kilolekyia)
4. *Strychnos henningsii* (Muteta)
5. *Lipa kituensis* (Muthieti)
6. *Aloe sp.* (Kiluma)
7. *Plectranthus pseudomaruboides* (Kiyo)
8. *Tithonia diversifolia* (mwivatha)

*Lippia kituensis*
Beautiful landscapes and important plants to human livelihoods.
Invasive Alien Species and Management

Invasive Species?
IAS are *non-indigenous species* that have been deliberately or accidentally introduced to new biogeographical system (Givens, 1994), and which then spread beyond cultivation and human care to impact biodiversity.
Invasive plant species

1. IAS-Aquatic

- *Salvinia*
- *Eichhornia*
- *Pistia*
- *Azolla*
- *Nicotiana*
2. IAS: Grasslands/Woodlands/forests

- **Opuntia spp.**
- **Tarchonanthus** (Leleswa)
- **Parthenium hysterophorus** (Parthenium Weed)
IAS: Farmlands

*Tithonia diversifolia*
(Mexican Sunflower)

*Catharanthus roseus*
(Madagascar Periwinkle)

*Calliandra calothyrsus*
(Calliandra)
IAS Impacts

IAS can have negative impacts at the species, population and community levels, and the most damaging significantly alter ecosystem functions and processes.

Community and Population Level Impacts

1. Resource competition and reduced recruitment (altered succession)
2. Competition for pollinators, seed dispersers and other mutualists
3. Population reductions and eliminations
4. Alterations in community composition and vegetation structure
5. Hybridization with native species
Ecosystem Level Impacts

1. Alterations in disturbance regimes (e.g. fire, hydrology, etc.)
2. Geomorphologic processes (erosion, sedimentation)
3. Soil chemistry (nutrients, nutrient cycles, pH)
Management strategy of IAS

Effectively strategy to manage IAS required at national and international-scale policies (e.g. Awareness of threats)

1. Assessment of current and potential threats and pathways
2. Prevention practices and policies
3. Early detection and rapid response
4. Management, control and restoration
5. Secured and maintained funding
Management efforts of IAS in Kenya

NMK’s EA herbarium through BioNET-EAFRINET, the East African partnership for Taxonomy, developed an IAS fact sheet of the Priority 100 IAS in the region (http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html)

Fact sheet details

| 2. Common names      | 10. Economic and other uses   |
| 3. Family            | 11. Environmental and other impacts |
| 5. Naturalised distribution (global) | 13. Legislation           |
| 6. Introduced, naturalised or invasive in East Africa | 14. References             |
| 7. Habitat           | 15. Editors                   |
| 8. Description       | 16. Acknowledgments           |
|                      | 17. Contact                   |
Invasive Plants

Invasive alien species may threaten native species as direct predators or competitors, as vectors of disease, or by modifying the habitat or altering native species dynamics. Entire ecosystems may be placed at risk through knock-on effects and given the critical role biodiversity plays in the maintenance of essential ecosystem functions. This interactive key and accompanying fact sheets provides a resource that can help those who wish to identify species of concern and to undertake management efforts to minimise their impact.
Azolla filiculoides (Red Water Fern)

Scientific name
Azolla filiculoides Lam.

Synonyms
A. arbuscula Desv.; A. filiculoides var. rubra (R. Br.) Strasb.; A. magellanica Wild.; A. squamosa Molina

Common names
Red water fern, water fern

Family
Azollaceae

Origin
Azolla filiculoides is native to most of South America.

Naturalised distribution (global)
Locations within which Azolla filiculoides is naturalised include western Europe, eastern, central and southern Africa, tropical Asia, North America, Australia and New Zealand.

Introduced, naturalised or invasive in East Africa
Azolla filiculoides is invasive in parts of Kenya, Uganda (A.B.R. Witt pers. obs.) and in Tanzania (Henderson 2002).
Species data from EA herbarium

Eichhornia crassipes
Ecological dynamics of invasive plant species: *Prosopis & Dodonaea*

‘Mathenge’

Spreading *Dodonaea*. An early warning system (Paper in prep.)
How can you get assessment data and information on IAS?

1. Field surveys,
2. Literature and internet database searches,
3. Collection records,
4. Remotely-sensed data, and
5. Experts and local professionals (academics, partners, etc.).
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